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# USSR Report

EARTH SCIENCES

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11 February 1985

**USSR REPORT  
EARTH SCIENCES**

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ARCTIC AND ANTARCTIC RESEARCH

DOCTORS STUDY HUMAN ADAPTABILITY TO ANTARCTICA

Dushanbe KOMMUNIST TADZHIKISTANA in Russian 6 Jun 84 p 4

[Interview with Alexander Vovsi-Kalshteyn by S. Dadashev, date and location not given]

[Excerpt] Six years ago Tajik scientists first participated in an expedition to the earth's sixth continent--Antarctica. Among expedition members were V. Belkin, doctor of medical sciences, and two colleagues from the alpine medical and biological research laboratory of the Tajik Academy of Sciences. The second time, during the 29th Soviet Antarctic Expedition, Tajikistan was represented by Aleksandr Vovsi-Kalshteyn, director of the laboratory for applied high-altitude physiology of the Tajik SSR Academy of Sciences, and by a laboratory colleague, Abdulkhamid Kayumov.

The problem of man's adaptation to extreme environmental conditions is extremely urgent in our times. It is not accidental that the sixth continent became the research object of the scientists of our republic: the scientific developments accomplished by them in Alpine conditions could be used in Antarctica.

Our correspondent met with A. Vovsi-Kalshteyn several days after he had returned to his native land.

[Answer] The basic idea of our expedition research may be expressed as an attempt, figuratively speaking, to clarify how adaptable the human organism is, how various people react to extreme environmental conditions, what kind of reserve the individual has, and work capacity under stressful situations.

Our mountainous republic long ago became for us a unique proving ground for experimentation. We applied the experimental work in this field to Antarctica. We selected a special group of subjects from among those engaged in the most complicated work and in whom the adaptation process would be most obvious. At home, we studied the features of adaptation of the organism of local inhabitants and newcomers to a high altitude in order to develop a selection criteria and prognosis of people's conditions. These developments were used in the high-altitude section of the sixth continent at an elevation of from 3.5 to 3.8 kilometers.

Research in Antarctica, taking account of our work in Pamir, will help make recommendations for a more well-rounded personnel recruitment for subsequent expeditions. It is no secret that each expedition requires significant resources. Therefore, the raw conditions require healthy people who are less subject to falling ill and failing to adapt. This means that there will be a better psychological climate in the collective, fewer wasted expenditures, and the possibility of accidents will be eliminated.

[Question] In our conversation the term "ice dome" has already been mentioned. What is this?

[Answer] An ice dome is elementary. All Antarctica is covered with a thick layer of ice, which in the polar region reaches a thickness of 3.5 kilometers. This is what an ice dome is. The highest point at which they are working in these conditions is dome B. I had a curious meeting there with two skuas. These birds inhabit the coast, and one can only guess how they came to the dome, 1,500 kilometers from the sea. Skuas have not been sighted so far inland. Evidently, the generosity of participants of long-distance transport trips enticed them. In fact, in Antarctica, relating to any living creative is very beneficial.

Participation in long scientific trips had not been planned for me. So when a vacancy for a doctor occurred, I took advantage of the opportunity. First of all, this presented the possibility of penetrating the depths of the continent, an opportunity which everyone who goes there does not have. And secondly, it made it possible to combine the practice of medicine with scientific research. I did not feel like a burden since I also happened to work as a cook. A particularly difficult case was on the occasion of giving medical assistance to one of the Leningraders who had many times before been at such elevations. In general, I managed to do the job. Its not proper to talk about the suppers. I tried to the extent of my knowledge of Central Asian cooking.

I was at four stations. Legendary names--Molodezhnaya, Mirnyy, Vostok--came to life in front of me. And, of course, I experienced 60-degree frost. This is when I remembered my favorite Jack London stories from my childhood. Dog teams alone didn't suffice for the exotic. Forty-ton Soviet snow cat-tractors were substituted for them as the most reliable method of transportation. And even the frost was not too frightening. We were well equipped: felt boots and special clothing out of camel hair. And, by the way, the serious training at the high-elevation village of Murgab, where I found out what 50-degree frost with wind was like, also helped.

En route, a small incident occurred. An IL-14 made a necessary visit to Komsomol traverse. In the strong frost we helped the fliers make a repair.

12318  
CSO: 1865/59

## THIRTIETH ANTARCTIC EXPEDITION USES NEW ROUTES

Moscow IZVESTIYA in Russian 9 Aug 84 p 1

[Interview with B. Krutskikh, director, Goskomgidromet Arctic and Antarctic Institute, by A. Viktorov in Leningrad, no date given]

[Excerpt] [Answer] At the youngest Soviet Antarctic station, Russkaya construction of various structures can be observed, including science pavilions. We hope valuable geomagnetic and other geophysical data may be obtained by participants in trips by caterpillar sledge trains to the interior of the continent, travelling new routes.

[Question] How many people will be in the forthcoming scientific "landing party?"

[Answer] The crew replacing the 29th Soviet Antarctic Expedition will consist of approximately 600 people. Roughly half of them have studied in the school of courage in previous antarctic winter quarters.

Scientists from the German Democratic Republic will winter over together with Soviet polar explorers on the icy continent. They will engage in research at Novolazarevskaya Station and Bellingsgauzen Station. Experienced researcher, D. Maksutov, candidate of technical sciences, has been designated as leader of the 30th expedition.

12318  
CSO: 1865/59

## DRILL FOR ANTARCTIC

Moscow TASS in Russian 0600 GMT 24 Oct 84

["Drill for the Antarctic"]

[Text] Leningrad, 24 Oct (TASS)--Soviet scientists are to research Antarctic glaciers with the help of new drilling equipment developed by Leningrad scientists. The cutting tool is mounted with a special device for collecting carbon dioxide directly from ice strata, carbon dioxide being the most precise indicator of the age of the strata. Hitherto such analysis has been carried out by core sampling. In the new device, up to 10 m<sup>3</sup> of ice melted at a certain depth is pumped through a special filter. The device is compact and easily fits with existing drilling equipment, and uses little power.

By analyzing ancient ice strata Soviet scientists hope to obtain information about climatic and atmospheric conditions in the distant past.

The Soviet Antarctic ice cap research program includes drilling at the "cold pole" of the planet, the interior continental station "Vostok", where a record depth of 2083 m for thermal drilling has already been achieved. Study has begun of coastal shelf glaciers of the Weddel Sea and drilling is underway at Novolazarevskaya and Pionerskaya stations.

CSO: 1865/131

PLANS FOR SEISMOACOUSTIC STUDIES OF ANTARCTIC SEA'S FLOOR

Leningrad LENINGRADSKAYA PRAVDA in Russian 22 Nov 84 p 2

[Text] Soviet scientists are beginning studies of the geological structure of the floor of the Ross Sea in Antarctica.

This task has been assigned to an expedition which set out yesterday from Leningrad on board the diesel-electric ship "Mikhail Somov". This ship is equipped with apparatus for seismoacoustic probing of the sea's depths. Soviet scientists have employed this method of research with success in many areas of the world's oceans. Seismoacoustics will be used for the first time in Antarctica.

The "Mikhail Somov" is the fourth vessel of the 30th Soviet Antarctic Expedition's fleet to sail for the south polar continent.

FTD/SNAP  
CSO: 1865/151

STATE PRIZE RECIPIENTS FOR RADAR ICE-MEASURING METHOD

Leningrad LENINGRADSKAYA PRAVDA in Russian 25 Nov 84 p 1

[Abstract] Photographs were given of five Leningrad residents who are recipients of the 1984 USSR State Prize. Among them are Candidate of Technical Sciences Aleksey Nikolayevich Chizhov, senior science associate of the State Hydrology Institute; and Al'bert Prokof'yevich Balabayev and Nikolay Ivanovich Komov, senior engineers of the Arctic and Antarctic Scientific Research Institute. These three received the award for development and introduction of a radar method and aircraft instruments for measurement of the thickness of sea and fresh-water ice.

FTD/SNAP  
CSO: 1865/151

SPATIAL DISTRIBUTION OF AURORAS AND ITS RELATIONSHIP TO GEOLOGICAL STRUCTURE  
OF NORIL'SK REGION

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: GEOLOGIYA I RAZVEDKA  
in Russian No 8, Aug 84 pp 18-23

KRAKOVETSKIY, Yu. K., POPOV, L. N., DORONINA, I. P. and CHAGAROV, L. M.,  
Noril'sk Evening Industrial Institute; Siberian Institute of Terrestrial  
Magnetism, Ionosphere and Radio Wave Propagation, Siberian Department,  
USSR Academy of Sciences; "Rudgeofizika" Scientific Production Association

[Abstract] A study is made of the interrelationship of spatial distribution  
of auroras and geological structure in the Noril'sk region. The spatial  
distribution of auroras was constructed based on materials obtained with  
the S-180 camera at Noril'sk Observatory. The geological structure of the  
Noril'sk region was analyzed within the limits encompassed by the photo-  
graphs. Each of the structural zones is named and briefly described. It  
was found that regions of minimum probability of appearance of auroras cor-  
responded with certain geological formations. An example is a minimum with  
a probability of 0.023 corresponding to the Evetkinskiy paleovolcano.  
Isolines with  $p = 0.023$  and  $p = 0.019$  encompass the Keta-Irbinskiy and  
Unoganskiy paleovolcanoes on the northwestern shore of Keta Island. The  
absence of any relationship of probability of appearance of auroras to  
local magnetic anomalies caused by differentiated intrusions of gabbro-  
dolerites or deposits of sulfide copper-nickel ores or magnetite ores and  
the seeming correlation of maxima with geological formations having very  
weak magnetization may result from deep basement structures. A study of  
this possibility is planned for the future. Figures 2, references:

9 Russian.

[97-6508]

DECADE OF THE 'VAVILOV KUPOLA'

Moscow ZEMLYA I VSELENNAYA in Russian No 5, Sep-Oct 84 pp 79-82

GOVORUKHA, L. S.

[Abstract] "Vavilov Kupola" is a glaciological research station operated by  
the Arctic and Antarctic Scientific Research Institute since 1974. It is  
located atop a dome-shaped glacier on an island in the Severnaya Zemlya  
archipelago. The station is 700 m above sea level, forcing scientists who  
work there to live almost constantly in the clouds. Continuous scientific  
studies at the station over the past 10 years have involved a series of  
glaciological, meteorological and actimetric observations, information  
on the amplitude of the variability of snow accumulation from year to year,

accumulation and ablation of glaciers, as well as air temperatures. Radar studies are used to determine internal structure and thickness of the Vavilov Glacier. Photographs of the scientists at work and brief, anecdotal descriptions of some of the studied phenomena are presented. Studies planned for the near future include an area tectonic, temperature and albedo survey of the dome and a study of its surface layers. Internal feeding of the glacier will also be studied and radar studies will measure the quantities of icebergs spawned. Figures 2.

[98-6508]

## METEOROLOGY

### ATLAS OF SNOW AND ICE RESOURCES

Tallinn TASS in Russian 29 May 84

[Text] Compilation has been completed in the Soviet Union of an atlas of the world's snow and ice resources; it will help to determine the influence of ice on the earth's climate. Soviet geographer Grigoriy Avsyuk, head of the organizing committee of the Eighth Symposium of Soviet glaciologists "Ice and Climate: Renewal and Forecasting", which opened today in the capital of Soviet Estonia, Tallinn, told a TASS correspondent about this.

In the course of work on the atlas, which was financed by the USSR Academy of Sciences and UNESCO, climatic patterns of individual mountain-glacier areas specifically came to light. It is expected, for example, that the limit of mountain agriculture in the Greater Caucasus will rise at the beginning of the 21st century to 300 meters or more.

Interest has increased in evaluating water resources in connection with the increase in industrial and agricultural use of water. We have established, said Grigoriy Avsyuk, that the summer thaw of sea ice in the Arctic basin alone causes the formation of four times the amount of fresh water in the total annual flow of such giant rivers as the Yenisey, Ob, Lena in Siberia and the Mackenzie in Canada.

At the same time an acceleration of thawing of polar ice, which threatens undesirable climatic consequences, due to a reduction in its reflectivity as a result of a drift of dust and soot to the Arctic, has been caused by the unchecked activity of enterprises of certain countries in the region, said the Soviet scientist in conclusion.

CSO: 1865/173

MAJOR GLACIATION EVENTS OF THE PAST AND THEIR GEOLOGICAL SIGNIFICANCE

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA GEOLOGICHESKAYA in Russian  
No 7, Jul 84 (manuscript received 5 Dec 83) pp 35-53

CHUMAKOV, N. M., Geology Institute, USSR Academy of Sciences, Moscow

[Abstract] The sequence, spatial and time scales of the major glaciation events, the paleoclimatic environment and their significance in geological history are discussed. Ancient glaciations were concentrated in four or five long intervals of geological history: the late Cenozoic, the middle to late Paleozoic, the late Riphean and the early Proterozoic. These glacial intervals show signs of repeated glaciations and lasted from 30 to 300 million years each. They are separated by periods of time varying from 120 million to 1400 million years during which glaciation was not observed. World climatic maps are presented for 9 different stages of geological history. The asymmetry of glaciation is noted: with polar or subpolar location of the continent in one of the hemispheres, cooling and glaciation in the hemisphere occupy significantly greater areas. Positive feedback was obviously involved. Glaciations and accompanying events have represented a significant portion of the post-Archean history of the earth and have also strongly influenced many geological and biological processes, making the study of ancient glaciations an important scientific task for geology today. The practical significance of such studies is determined by the association of deposits of oil, gas, iron and manganese with glacial deposits or sediments covering the glacial deposits. The study of ancient glaciations is necessary for an understanding of the causes of climatic fluctuations and prediction of trends in long-term changes of the earth's climate. Figures 10; references 85: 37 Russian, 48 Western.

[27-6508]

## OCEANOGRAPHY

### RESEARCH SHIPS 'VITYAZ'' AND 'RIFT' TO COLLECT SAMPLES WITH MANIPULATOR ARM, CORERS, DREDGES

Moscow TASS in Russian 18 Jul 84

[Text] Two soviet research vessels, the "Vityaz'" and "Rift," have set sail from the Black Sea port of Novorossiysk to the Mediterranean on an oceanographic expedition which will concentrate on studying underwater mountain ranges, PRAVDA reported today. The work, it added, is important to scientists since it is connected with a new theory about the planet's development, the origin of lithosphere plates, the drift of continents, the formation of minerals and other problems.

Of course, oceanographers already have information about seabed ranges. But it has, as a rule, been collected from the surface, while underwater observations are needed to study them in a more thorough way. This is why members of the expedition plan to take a look at underwater mountains with their own eyes--with the help of a three-man underwater apparatus called "Argus," which is carried by the "Vityaz'."

The mini-sub is called after a 100-eyed mythical creature and has its eyes, too: three portholes making it possible for the three crew members to conduct visual observations and take still and motion pictures of the outside. "Argus" also has a manipulator arm which can easily be used to take samples of seabed ground, rock or plants abroad.

"Argus" is intended to study slopes of underground hills, while the most interesting of their peaks will be visited by frogmen for whom there is a special hyperbaric complex on the "Vityaz'." Expedition plans provide for making dives to depths of 250 meters.

They also envision observations using up-to-date instruments from the surface, including geological, gravimetric and magnetic studies. Besides "Argus," seabed ground samples will be taken by corers and dredges. In all, the "Vityaz'" has 20 different laboratories. Some of the experiments will involve scientists from Mediterranean countries.

CSO: 1865/294

## NEW GAS INDUSTRY SHIP DISCUSSED

Moscow MORSKOY FLOT in Russian No 10, Oct 84 p 47

[Unsigned article: "New Research Ship"]

[Text] The flagship "Akademik Gamburtsev" has been built at the A/O "Layvateollisuus" shipyards in Finland for the Ministry of the Gas Industry. The new ship is designed to carry out a combination of geodetic investigations to study the geological structure of the sea floor in various water areas and to prepare the areas which seem promising for oil and gas for deep exploratory drilling with floating drill rigs. The hull used in its construction is of the sort used in earlier-built scientific research ships of the "Akademik Shuleykin" type.

The overall length of the ship is 71.6 meters, width is 12.8 meters, the draft with a full load is 4.5 meters, dead weight is 600 tons and speed is 14 knots. The ship has unlimited navigation range and is designed to operate in the tropics and arctic areas. Potable water supplies and provisions (calculated for 62 persons), and also fuel reserves, guarantee 50 days independent navigation. The ship was built according to the official guidelines and under the supervision of the USSR Register as a Class KM (sea-going) ★ UL I A2 (research) vessel.

A basic seismographic laboratory is located on the upper deck, the bow side of which has compartments for magnetic tapes and for repair and maintenance of electronic instruments. The gravimetric laboratory is located on the second deck. The compartment for the integrated navigation system is located on the bridge deck, astern of the deckhouse.

The ship's hull is of completely welded construction. The upper deckhouse is made of aluminum.

The anchor-handling gear includes two standard anchors and one spare Hall anchor, and a domestically-produced B-5 windlass which has 15 kW of power. Mooring operations are done with a capstan of 7.6 kW of power. The electro-hydraulic steering engine produces 98 kN/meter and can lay the rudder over up to 65°. A steering device, located on the bow and powered by a 147 kw electric motor, has been provided to improve the controllability of the ship in small movements and to provide motionless operation.

The boat gear consists of two 40-place, covered-type motorized lifeboats. They are made of glass-plastic and are powered by 16.2-kW-capacity water-cooled diesel engines. In addition, there are four inflatable life rafts and a utility boat.

Electrohydraulic cranes from the Gidroplan firm, one with a hoisting capacity of two tons, at the bow, and one with a hoisting capacity of three tons, at the stern, have been provided for use as cargo-handling gear.

In order to carry out research work the ship is equipped with a seismographic electrohydraulic winch used in operations with the "string" of seismic detectors and there are winches on both sides of the ship astern of the upper deck, etc.

The ship is equipped with an "Intering" stabilizing system to reduce roll.

The ship is also equipped with two G-74 six-cylinder, four-stroke diesel gas turbine supercharged engines which have 1147 kW capacity at a rotational speed of 500 rpm. The engines transmit power through a reduction gear and a propeller shaft to the variable-pitch screw [VRSh]. There is a power take-off out of the reduction gear box which is used for the shaft generator, which operates constantly while the propeller shaft is rotating. The four-blade variable-pitch screw is made of high-strength bronze. The stern tube bearings are made of cast rubber with a constant water flow-through.

The propulsion plant meets the requirements of the UL ice class, i.e., it is supplied with four spare screw blades and a propeller shaft. Remote control of the main engines and the screw pitch is carried out by a KaMeVa system. Manual control is also available from a nearby station.

The power plant equipment consists of three DGP 150/750 diesel generators and one DGA 50-9R emergency generator, all of which are manufactured domestically. While under way, the shaft generator is the primary power source.

The boiler plant consists of one LNK-1000-5 auxiliary fire-tube boiler which has an output of one ton/hour, and two waste-heat boilers which have a capacity of 0.3 tons/hour. The auxiliary boiler is completely automated. Parallel operation capability is provided for.

The vessel satisfies the requirements of the International Convention on Prevention of Pollution from Ships and is equipped with up-to-date electric radio navigation instruments which guarantee safe sailing.

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12659

CSO: 1865/11

RESEARCH SHIP 'DOROFEEV' STUDIES BALTIC-NORTH SEA REGION

Leningrad VECHERNIY LENINGRAD in Russian 31 Aug 84 p 3

[Article by Yu. Trefilov]

[Text] After completing a special assignment, the Leningrad Hydrometeorological Institute's (LGMI) scientific expeditionary ship "Professor Dorofeyev" has moored at one of the berths of the Port [of Leningrad]. This is what Candidate of Technical Sciences V. P. Korovin, the leader of the expedition, reported:

"Our ship, which was commanded by the experienced captain A. G. Novozhilov, spent almost 40 days in the Baltic Sea and North Sea. In addition to the scientific personnel, two groups of students of the school of oceanology of LGMI and the school of geography of Leningrad State University were on board. Our expedition's main task was to provide practical training for second-year students. Under the direction of experienced specialists, the students conducted studies of processes of water transfer between the Baltic and North seas and studied their hydrometeorological condition in summer."

"Where was your floating station located?"

"For three weeks, we anchored in the southern Baltic Sea, in the area of the Slupsk Trench, where we conducted our main work. Here, too, we set up an automatic buoy station,

on which instruments for studying the velocity and direction of currents, temperatures and other data were installed."

"What is the practical importance of these studies?"

"Their main effect still lies ahead. We conducted our research as part of the extensive program 'International Project Baltic Sea', which calls for study of the Baltic Sea as a single ecological object and for measures for its protection. More than 20 organizations of our country are taking part in this program, including LGMI. Four times a day we sent information to Leningrad weather forecasters and to the Center of Oceanological Data, which is located in Obninsk. The results obtained will be used in scientific and diploma papers of students and in their course work."

FTD/SNAP  
CSO: 1865/151

## SEA-CURRENT MEASURING INSTRUMENT

Leningrad LENINGRADSKAYA PRAVDA in Russian 11 Nov 84 p 2

[Article by A. Potapenko]

[Text] An instrument for measuring the speed and direction of sea currents has been developed under the direction of docent A. Ye. Til'man in scientific laboratories of the Leningrad Shipbuilding Institute. Meteorologists will be able to forecast the weather more quickly and accurately with the aid of this instrument.

Independence of operation at various depths and the capability of obtaining data immediately at the moment when sea currents are measured are distinctive features of the new instrument. Its design allows it to be connected to a computer for recording and processing of results.

Five full-size mockups of the instrument have been built at the test-and-experimental plant "Nakat".

Laboratory tests conducted at an experimental facility of the State Hydrology Institute have confirmed the high qualities of the measuring complex.

FTD/SNAP  
CSO: 1865/151

**'R-11' SHIPBOARD COMPUTER DEVELOPED AT HUNGARIAN ASSOCIATION**

Moscow VODNYY TRANSPORT in Russian 20 Oct 84 p 1

[Text] Specialists of the computer technology association in Szekesfehervar have developed a computer, the "R-11," which is intended for operation both in the field of geophysical research and on board seagoing ships. This association is a joint enterprise of the physics research institute, the computer technology institute and the "Videoton" radio and television equipment plant.

The computer is capable of withstanding large mechanical stresses and temperature fluctuations, and of operating in conditions of stormy seas. It was developed to orders of foreign customers, primarily the Soviet Union.

The workers of the "Videoton" plant are constantly improving their production technology and supplying their partners in fraternal socialist countries with products of high quality. This development of cooperation in the field of electronics is taking on particular importance in connection with the implementation of decisions of the top-level economic conference of member-countries of the Council for Mutual Economic Aid which was held in Moscow.

FTD/SNAP  
CSO: 1865/120

RESEARCH SHIP 'SAMOYLOVICH' COMPLETES BALTIC SEA STUDIES

Leningrad LENINGRADSKAYA PRAVDA in Russian 14 Dec 84 p 4

[Article by A. Kozlovskiy]

[Excerpt] After completing field work in the Baltic Sea, the research ship "Rudol'f Samoylovich" of the Arctic and Antarctic Scientific Research Institute (AANII) has returned to Leningrad.

The oceanologists conducted measurements essential for the study of the wind and wave conditions of the Baltic Sea. The main research task of the Leningrad scientists during this cruise was to lay the groundwork for the efficient design of engineering installations in the open sea which would be capable of withstanding the force of any natural elements.

Scientists of the Leningrad Branch of the Oceanographic Institute, who had done analogous studies for the construction of a complex of floodland, took part in this research along with the representatives of the AANII.

FTD/SNAP  
CSO: 1865/171

EVOLUTION OF SEDIMENTATION BASINS IN EARTH'S HISTORY

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA GEOLOGICHESKAYA in Russian  
No 7, Jul 84 (manuscript received 30 Jan 83) pp 10-34

TIMOFEEV, P. P. and KHOLODOV, V. N., Geology Institute, USSR Academy  
of Sciences, Moscow

[Abstract] In studies of contemporary sedimentation, the plant must be considered a single geological system, with almost the entire continental block acting as an area of mobilization of sedimentary, effusive-sedimentary and magmatic material. However, the geological history of the oceans as revealed by deep sea drilling encompasses only about the past 200 million years, from the Jurassic through the Quaternary. The older Paleozoic deposits can be found only on oceanic islands adjacent to the continents. DSDP boreholes into the sedimentary cover thus reveal only about 5% of the earth's history. Information on the Precambrian paleo-oceans is virtually nonexistent. Analysis of factual materials rather convincingly indicates that the lower Paleozoic strata of central Eurasia differ significantly from contemporary abyssal-pelagic oceanic sediments, having been accumulated under conditions more like those observed in shallow seas. Arrival of water and many other volatile components from the mantle occurred over a geologically long period of time and was approximately proportional to the quantity of basalt melted. The question of the kinetics of delivery of the gas fraction and water to the earth's surface remains open. The data presented in this article indicate a certain directionality in the development of types of sedimentary processes over time, with an increase in the degree of contrast of the relief of the planet. From the Archean to Quaternary the differences between levels of upthrusts and depressions continually increase, the height of mountain ridges and of the continents increases, trench morphometry of the seas and oceans increases, the volume of sea water and ocean water increases, particularly in Postpaleozoic time. Quite similar shallow-water sediment accumulation conditions were observed in the Jurassic and Cretaceous periods both in contemporary oceanic basins and over a portion of the contemporary continental block. At the end of the late Cretaceous and beginning of the Paleogenetic period, as a result of separation and depression of tremendous areas of America, Eurasia, Africa and Australia, the contemporary ocean began to develop. This event has been observed in boreholes as the broad-scale occurrence of deep-water red clays. The deepening of the ocean depressions which occurred in the Cenozoic completed the stabilization period and led to the development of actual oceanic sedimentation. Figures 7, tables 1; references 143: 116 Russian, 27 Western.

[27-6508]

TYPES OF PLACER FORMATION CONDITIONS ON EASTERN ARCTIC SHELF

Moscow SOVETSKAYA GEOLOGIYA in Russian No 9, Sep 84 pp 33-37

BEZRODNYKH, Yu. P., All-Union Scientific Research Institute of Marine Geology

[Abstract] The conditions existing near protrusions of the bedrock basement on the Cenozoic eastern Arctic shelf facilitate the concentration of metal-bearing minerals of variable granular composition and the formation of multilayer polyfacial placers of great thickness similar to continental placers formed at the boundary of structures with different directions of tectonic movement. The unique morphology, genesis and composition of such metal-bearing deposits is most characteristic for tin placers. A significantly greater fraction of the metal of crustal sources accumulates here than in river valleys, primarily due to the concentration of small and very small fractions of particles. Changes in sedimentation conditions as a result of fluctuations of sea level in Cenozoic time caused close placement and joining of deposits of alluvial and littoral-marine deposits of different ages. Placers of this type are also polygenetic varieties, though their productive deposits vary in genetic type and age in the lateral direction within the limits of the basal horizon. Regional studies in this area should be oriented toward locating areas of upthrust of the shelf basin around the edges of downwarps and studying their geological structure. It is important for quantitative prediction to determine the coefficients which relate reserves of metal in placer and crustal sources for the various morphostructures of the boundary zone. The problem of concentration of metals in allochthonic formations remains unresolved, and its solution will define the prospects for metal content in the entire eastern Arctic shelf area. Particular attention should be given to Prequaternary horizons consisting of chemically weathered crustal materials.

[109-6508]

UDC 551.463:5:577.4:51

CALCULATION OF OPTICAL CHARACTERISTICS OF SHELF ECOLOGICAL SYSTEM BASED ON ITS MATHEMATICAL MODEL

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 277, No 6, Aug 84  
(manuscript received 25 Oct 83) pp 1345-1347

BELYAYEV, V. I. and POPLAVSKAYA, M. G., Marine Hydrophysics Institute, Ukrainian Academy of Sciences, Sevastopol

[Abstract] The annual course of concentrations of wet phytoplankton mass and the equivalent biomass of nonliving organic matter obtained in an earlier work are used to calculate the spectral functions  $B(\lambda)$ ,  $\kappa(\lambda)$  and  $R(\lambda)$ , where  $\lambda$  is 400-700 nm of a shelf ecological system. Seasonal differences in the  $\kappa(\lambda)$  spectra result from changes in the content of dissolved and suspended organic matter. The annual course of  $\kappa(\lambda)$  has three maxima, the first resulting from a high content of pigments characteristic for the spring "bloom," the second resulting from a high concentration of yellow matter, and the third corresponding to the autumn season. Figures 2, references 8: 6 Russian, 2 Western.

[70-6508]

UDC 551.464.6.02

INTRUSION OF RADIOACTIVE INDUSTRIALLY POLLUTED WATER FROM NORTH SEA INTO CENTRAL BALTIC SEA

Moscow ATOMNAYA ENERGIYA in Russian No 3, Sep 84 (manuscript received 21 Feb 84) pp 186-188

VAKULOVSKIY, S. M. and NIKITIN, A. I.

[Abstract] In order to study the problem of penetration of radioactive industrially polluted water into the central Baltic Sea, in July of 1983 the authors determined the content of  $^{134}\text{Cs}$  in water near the bottom of deep-water trenches along the path traveled by North Sea water entering the Baltic. Samples were taken at 5 locations, with  $^{134}\text{Cs}$  concentrated from samples of several thousands of liters. It was found that radioactive pollution caused by the entry of water from the North Sea extends through the system of deep-water depressions into the Baltic as far as the Gotland trench. The greatest degree of contamination is found in the Arkona depression adjacent to the straits. The concentration of  $^{134}\text{Cs}$  in the Gdansk trench is  $\frac{1}{2}$  as great, in the Gotland trench  $\frac{1}{3}$  as great as in the Arkona depression, resulting both from dilution and from decay of  $^{134}\text{Cs}$  as it moves through the sea. Radioactive contamination in the Baltic is attributed to discharge of radioactive wastes by plants at Windscale. Figures 1, tables 1; references 9: 5 Russian, 4 Western.

[91-6508]

UDC 553.078+553.412(265)

SILVER METALLOGENY IN EARTH'S PACIFIC OCEAN SEGMENT

Novosibirsk TIKHOKEANSKAYA GEOLOGIYA in Russian No 4, Jul-Aug 84  
(manuscript received 22 Nov 83) pp 3-14

SHCHEGLOV, A. D., KHOMICH, V. G. and GOVOROV, I. N., Far Eastern Geology Institute, Far Eastern Scientific Center, USSR Academy of Sciences, Vladivostok

[Abstract] Within the Pacific Ocean segment of the earth there are various orders of zonality in the location of silver and silver-bearing deposits. This article presents maps and scales outlining this zonality in the magmatic rocks of various Pacific Ocean structures and the location of major silver belts and zones in and around the Pacific, along the western coast of North and Central America and in Japan, based on Australian, American, Mexican, Soviet, Phillipine, Japanese and New Zealand sources. Silver forms both large independent and complex ore formations of varying age around the Pacific. Industrial concentrations of silver are frequently associated with gold and polymetals. There is a clear relationship between silver and tin, manganese, potassium, less frequently fluorine, in the Pacific area. Silver in independent concentrations is found in younger ore formations from the Cretaceous, Paleogenic and Neogenic times, for which it is characteristically associated with volcanic continental formations on hard consolidated substrates of various ages and types of structures. Figures 5, tables 2; references 22: 10 Russian, 12 Western.

[85-6508]

UDC 551.242.24

NEW DATA ON STRUCTURE OF SHIRSHOV RIDGE (BERING SEA)

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 277, No 6, Aug 84  
(manuscript received 17 Jan 84) pp 1459-1463

NEPROCHNOV, Yu. P., SEDOV, V. V., MERKLIN, L. R. and RUDNIK, G. B., Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow

[Abstract] Geological and geophysical work was performed in the Bering Sea in the summer of 1982 during the 29th cruise of the research vessel "Dmitriy Mendeleyev." One of the main objects of study was Shirshov Ridge, which separates the sea into the Aleutian and Komandorskiy Basins. Special studies of Shirshov Ridge were performed in two areas, and included sonar soundings, continuous seismic profiling, magnetometry, deep seismic soundings, dredging and underwater photography, geological-geochemical work and

geothermal measurements at the peak of the ridge. Data were obtained for the first time on the structure of the earth's crust beneath Shirshov Ridge. The thickness of the crust in the northern portion of the ridge was found to be about 18 km. Shirshov Ridge is thus primarily formed of imbricate thrusts of the crust of the Aleutian Basin caused by great horizontal compression. The crustal rocks of the ridge consist of three associations, the first amphibolites, dolerites, quartz gabbro-dolerites and quartz and biotite-containing gabbro; the second consists of slightly lithified tuff-sandstones, tuff-gravelites of late Miocene age. The first two associations can be considered part of the ancient ocean crust brought to the surface upon tectonic movement due to the influence of horizontal compression in the early stages of ridge formation. Figures 3, references 11: 6 Russian, 5 Western.

[70-6508]

UDC 534.231.1

BEHAVIOR OF MODE FREQUENCY CHARACTERISTICS IN SHALLOW SEA WITH VARIATION OF P-WAVE VELOCITY IN BOTTOM SEDIMENT LAYER AND SONIC VELOCITY PROFILE IN WATER LAYER

Moscow AKUSTICHESKIY ZHURNAL in Russian No 5, Sep-Oct 84  
(manuscript received 30 Mar 83) pp 577-584

AGEYEVA, N. S. and KRUPIN, V. D., Acoustics Institute imeni N. M. Andreyev, USSR Academy of Sciences

[Abstract] An analysis is presented of changes in modal frequency characteristics in a shallow sea upon variation of longitudinal wave velocity in the sedimentary layer of the bottom and the profile of the speed of sound in the water layer. The thickness of the water layer was assumed to be 65 m, initial velocity profile with negative gradient in water layer assigned by a table presented in the article, thickness of the sediment layer on the bottom 60 m, P-wave velocity in sediment layer varying between 1430 and 1570 m/s, loss coefficient  $10^{-3}$ , density  $1.4 \text{ g/cm}^3$ , parameters of lower liquid half space  $\eta_L = 0$ ,  $\rho_L = \text{g/cm}^3$  and  $c_L = 1795 \text{ m/s}$ . The characteristics of modes in a shallow sea with a stratified absorbing bottom were found to differ quite basically as a function of whether the speed of sound in the bottom sediment was greater or less than the minimum speed of sound in the water. Since the distribution of attenuation coefficients by mode numbers is complex and irregular, greater caution must be taken in limiting the mode numbers in calculating a summary sound field. Figures 7, references 3: 2 Russian, 1 Western.

[93-6508]

UDC 534.26

INFLUENCE OF BRAGG REFLECTING LATTICE GROOVE DEPTH MODULATION ON RAYLEIGH WAVE REFLECTION COEFFICIENT

Moscow AKUSTICHESKIY ZHURNAL in Russian No 5, Sep-Oct 84  
(manuscript received 7 Jun 83) pp 585-588

ALYAKNA, Yu. Yu., GULYAYEV, Yu. V., KOZLOV, A. I. and PLESSKIY, V. P.,  
Radio Engineering and Electronics Institute, USSR Academy of Sciences

[Abstract] A method is suggested for calculating the characteristics of modulated reflecting lattices, and characteristics are calculated for a number of specific cases. Special selection of the weighting function can significantly reduce the degree of reflection of waves outside the Bragg band while retaining a near unity coefficient of reflection at the central Bragg frequency. Figures 2, references 13: 5 Russian, 8 Western.  
[93-6508]

UDC 534.44

PRELIMINARY RESULTS OF STUDY OF SPACE-TIME VARIABILITY OF SHALLOW SEA ON STEADY ACOUSTICAL PATH

Moscow AKUSTICHESKIY ZHURNAL in Russian No 5, Sep-Oct 84  
(manuscript received 12 May 83) pp 594-598

BUNKIN, F. V., VAVILIN, A. V., ZHURAVLEV, V. A., KRAVTSOV, Yu. A., LYUBCHENKO, A. Yu., OMEL'CHENKO, N. N., PETNIKOV, V. G., KUDIYEV, L. T. and SHMELEV, A. Yu., General Physics Institute, USSR Academy of Sciences

[Abstract] A steady acoustical path was organized in a shallow sea in 1982. The depth of the sea along the path was a few hundred meters. The radiating system consisted of two electromagnetic sources with a resonant frequency of a few hundred hertz. Experiments involved emission of two audiofrequency signals simultaneously in bursts of about 1200 seconds separated by pauses of 20 seconds. The apparatus used was able to maintain signal phase from pulse to pulse. Variations were found in the phase of the leading edge of the sound wave in the horizontal plane by up to  $0.5^\circ$ . The signal envelope was found to contain components with periods of 6, 8, 12 and 24 hours plus many spectral components with periods of a few minutes to a few hours. Acoustical soundings over a steady path thus revealed the characteristic time and space scales of variation of the acoustical field in a shallow sea. Figures 7, references 7: 5 Russian, 2 Western.  
[93-6508]

UDC 534.87;551.463.26:534

SPECIFICS OF BACKSCATTERING OF SOUND BY BOTTOM OF BANK IN OPEN SEA

Moscow AKUSTICHESKIY ZHURNAL in Russian No 5, Sep-Oct 84  
(manuscript received 14 Mar 83) pp 599-604

BUNCHUK, A. V., ZHUTKOVSKIY, Yu. Yu. and LYSANOV, Yu. P., Acoustics Institute imeni N. N. Andreyev, USSR Academy of Sciences; Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences

[Abstract] Measurements of the angular and frequency variation of back-scattering coefficients of sound by the bottom of a bank were performed independently by a pulse method and a tone-pulse method. The pulse method utilized surface explosions of 200 g charges; the second method utilized a special deep-water receiving system operating in the tone-pulse mode with a pulse length setting of several ms, carrier frequency 5 KHz. The sound receiver and source were both nondirectional. Analysis of the results indicated that the bottom of the bank was a hard base, for example, cooled lava from an underwater volcano, covered by a layer of loose sediment a few meters thick. The experiments confirmed that the structure of the bottom sediments is important, in this case decisive, in the process of backscattering of sound by the bottom. Figures 3, references 7: 6 Russian, 1 Western.

[93-6508]

UDC 534.231.1,534-13;534.86

AVERAGE SOUND INTENSITY DECREASE RULE IN IRREGULAR HYDROACOUSTICAL WAVEGUIDE

Moscow AKUSTICHESKIY ZHURNAL in Russian No 5, Sep-Oct 84  
(manuscript received 23 Feb 83) pp 643-648

KATSNEL'SON, B. G. and KULAPIN, L. G., Voronezh State University imeni Lenin's Komsomol

[Abstract] A study was made of the change of average intensity with distance in irregular sound channels in which the rays experience multiple reflections from an absorbing surface. This is the case in a shallow sea with depth variable over its length in a sound channel which conforms to the bottom or surface. Analytic expressions are obtained for the intensity of the sonic field as a function of distance traveled through the channel, and the results are compared with calculations based on summation of modes. Figures 3, references 7: 3 Russian, 4 Western.

[93-6508]

UDC 528.71:551.462

## PROCESSING OF UNDERWATER PHOTOGRAPHS

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 8, Aug 84 pp 44-46

MELINA, Ye. A.

[Abstract] Underwater stereophotogrammetric survey photographs generally include no reference points and insufficient numbers of control points, preventing the use of rigorous photogrammetric processing methods. The specifics of underwater stereosurveying require some changes in methods for processing pairs of photographs. Special coordinates are determined at the author's laboratory by direct photogrammetric intersection by an analytic method involving a computer. The major stages in analytic processing of photographs include measurement of coordinates of points on the stero pairs, transformation of measured coordinates to a base coordinate system by known equations, reducing the coordinates of the points on the pair, computation of photogrammetric coordinates of object points by equations presented in the article and determination of distances between the points. The method is intended for determination of quantitative characteristics of biological objects in oceanographic studies and can be used to study the microrelief of the sea bottom. Figures 1, references: 3 Russian.

[88-6508]

UDC 549.521.4:551.461.6

## ALUMINUM IN BIOGENIC CYCLE AND FORMS OF ITS OCCURRENCE IN OCEAN

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA GEOLOGICHESKAYA in Russian No 9, Sep 84 (manuscript received 5 Jan 83) pp 79-89

DEMINA, L. L., LISITSYN, A. P. and LUKASHIN, V. N., Oceanology Institute, USSR Academy of Sciences, Moscow

[Abstract] Specimens of surface suspension and bottom sediments were repeatedly chemically leached to yield information on forms of aluminum in the ocean. The quantity of aluminum utilized by plankton in the photic zone is  $11 \cdot 10^{12}$  g/yr, more than double the receipts of aluminum into the ocean dissolved in river runoff. Aluminum must thus pass through the biological cycle at least twice per year. Marine organisms concentrate Al from sea water by a factor of 10<sup>2</sup>-10<sup>5</sup>. Significant quantities of aluminum are included in the organic fraction in sea water. Al is clearly not a terrigenous component of the ocean, brought in by river and atmospheric suspensions. A portion of it passes through the biological cycle and is converted to organomineral forms, entering the sediment as colloidal forms which are gradually decrystallized. The use of aluminum in sediment as an indicator of lithogenic material is reliable only

in lithogenic sediments. In typical pelagic sediment the terrigenous Al matrix method is inadequate, as it is for oceanic suspensions. Figures 3, tables 5; references 23: 7 Russian, 16 Western.  
[86-6508]

UDC 553.98:551.76(540)

ORGANOGENIC STRUCTURES (SUBMERGED REEFS) IN SILHETIAN LIMESTONE OF WEST BENGAL BASIN

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA GEOLOGICHESKAYA in Russian No 9, Sep 84 (manuscript received 18 Dec 83) pp 102-109

MOSKVICH, V. A., Geochemistry and Geophysics Institute, Belorussian Academy of Sciences

[Abstract] Organogenic structures of the Silhetian suite of the western Bengal petroleum basin were studied based on materials from deep drilling, seismic prospecting by the common depth point method and geological surveying. Geophysical data from deep holes were correlated with paleontological data, including paleopalynological data and geophysical findings concerning the lithologic characteristics of sections, as well as geological survey material, in order to correlate the Eocene deposits. The structure of the Eocene deposits is described and schematically diagrammed. Conditions of formation and location of organogenic structures are discussed. The basic reef formers are red algae, less frequently bryozoans. Collectors were primarily developed in organogenic structures consisting of bryozoans which later underwent intensive secondary dolomitization. The propagation of the organogenic structures was controlled by cosedimentation tectonic movements related to the development of the Calcutta-Mymensingh zone of the lateral bench. This was developed in the Eocene as a transitional band between an uncompensated depression in the east and a stable area of compensated sediment accumulation in the west of the basin. Some of the organogenic structures delineated may contain oil and gas.

Figures 4, references 11: 4 Russian, 7 Western.  
[86-6508]

PHYSICS OF ATMOSPHERE

LASER AIR POLLUTION MONITORING SYSTEM PLANNED FOR MOSCOW

Moscow MOSKOVSKAYA PRAVDA in Russian 1 Dec 84 p 3

[Excerpt] Scientists of the Institute of Applied Geophysics have proposed a scheme for setting up a comprehensive system of laser posts which would keep track of the purity of Moscow's air.

The first laser air-purity station has been located in a high-rise building on Bol'shaya Cherkizovskaya Street. The concentration of pollutants in the air is determined according to the brightness of emitted and reflected laser beams. The data of each laser shot are shown quickly in the form of control numbers on screens of instruments.

Units of this type can determine the condition of the atmosphere according to the most varied parameters. The institute's scientists have tested lasers which are capable of reacting sensitively to the presence in air of ozone, ammonia, sulfur dioxide, and nitrogen oxides. Stand and field tests have been conducted with this apparatus.

The scientists plan to install several units with different designations in a single place. The whole system will be capable of operating automatically. All the lasers, each tuned at a set frequency for its own type of pollution, will emit control shots of light beams. They will be aimed at any reflecting surface located at an appropriate distance -- the facade of a building or a high wall, for example. The intensity of the emitted and 'returning' beams will be compared. The result will be accurate data on the presence in the air at any given moment of gaseous pollutants or aerosols.

ATD/SNAP  
CSO: 1865/151

## DISCOVERY ABOUT TEMPERATURE FLUCTUATIONS IN TURBULENT AIR FLOWS

Moscow VECHERNYAYA MOSKVA in Russian 19 Oct 84 p 2

[Text] The USSR State Committee on Inventions and Discoveries recorded a major scientific discovery today.

Its author is academician A.M. Obukhov, director of the USSR Academy of Sciences' Institute of Atmospheric Physics. The priority of the Moscow scientist's work is that he is the first to discover the previously unknown law of spatial fluctuations of temperature in a turbulent flow in the atmosphere. This discovery is the result of 35 years of painstaking research.

The turbulent movement of air in the atmosphere is well known to everyone. It manifests itself in random changes in wind velocity and in the dispersal of smoke, for example. If a miniature thermometer with sufficient sensitivity and speed of response were placed in an [air] flow, its readings would fluctuate chaotically against the background of average temperature. This is characteristic of practically every point of the flow. The temperature field forms as a result of the mixing of the air.

Academician A.M. Obukhov proposed using the relation of the mean square of the difference in temperatures of two points to the distance between these points as the structural characteristic of this field. It was found that the dissipation of energy in a flow and the equalization of temperatures are connected with the breaking up of eddies in a turbulent flow into smaller ones. Their energy in turn is converted into heat due to the viscosity of the medium.

The law that has been discovered makes for a much broader field of application of physical methods of analyzing atmospheric phenomena. In practice, the discovery entails the possibility of calculating disturbance characteristics of light and radio waves, and it is of great importance in laser technology for communications, location and geodesy.

FTD/SNAP  
CSO: 1865/120

UDC 550.388

STUDY OF LOWER IONOSPHERE BY PULSE CROSS-MODULATION METHOD

Kiev GEOFIZICHESKIY ZHURNAL in Russian Vol 6, No 5, Sep-Oct 84  
(manuscript received 30 Dec 83) pp 46-58

CHERNOGOR, L. F., Khar'kov University

[Abstract] Cross-modulation is one of the major radiophysical methods used to study the lower ionosphere from the earth. Three installations of this type have been set up in the USSR. In contrast to foreign studies, Soviet work has been developed in the following directions: 1) simultaneous use of a number of independent methods; 2) use of broadband apparatus operating in the 1 to 6 MHz band; 3) utilization of both stationary and mobile installations; 4) utilization of high powers (10 to 100 MW per pulse). This article presents the theoretical principles of the cross-modulation method, measurement and processing methods, and presents an evaluation of possibilities and errors of the method. Advantages of the method include the fact that it allows collection of information on the lower portion of the ionosphere, including the C layer, in the daytime as well as the base of the ionosphere at 75 to 90 km at night. The method can in principle be used for determination of the values of  $\delta_0$ ,  $T_{eo}$  and possibly other parameters of microprocesses. Shortcomings include the requirement for the use of rather complex apparatus, the complex theory and methods of data processing involved. It is therefore a useful method for studying the lower ionosphere, but a better method for systematic studies of the D region is the partial reflections method. Future attention should be concentrated in the following areas: 1) formulation of a statistical theory of the method; 2) development of a statistical theory of measurements and signal processing; 3) solution of the problem of error in these methods; 4) broader utilization of high-power installations in systematic studies. Figures 2, references 55: 28 Russian, 27 Western.  
[107-6508]

UDC 551.574.11

CONDENSATIONAL TRANSFORMATION OF ATMOSPHERIC AEROSOL PARTICLE DISTRIBUTION FUNCTIONS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 277, No 6, Aug 84  
(manuscript received 20 Sep 83) pp 1347-1350

LAKTIONOV, A. G., Applied Geophysics Institute imeni Ye. K. Fedorov, Moscow

[Abstract] In order to solve the problem of condensational transformation of the distribution function of aerosol particles, the author studies

conditions of equilibrium of particles for a given radius and relative humidity, determining these factors by means of a single distribution function of nuclei. Equations are derived which describe the condensational transformation of distribution functions of aerosol particle size concentrations, fixed by a single easily measured supersaturation distribution function. The model of condensational processes in the aerosol allows the inverse problem of determining the function of the nuclei with respect to supersaturations to be solved using the known particle size distribution functions. Experimentally measured quantities agree well with data calculated by the theory developed in this article. Figures 1, references 5: 4 Russian, 1 Western.

[70-6508]

TERRESTRIAL GEOPHYSICS

KIRGIZ PRIZE NOMINATION FOR MINING EXPLOSIVES

Frunze SOVETSKAYA KIRGIZIYA in Russian 18 Oct 84 p 3

[Article by T. Martysyuk, senior engineer of the Kirgiz Institute of Scientific and Technical Information]

[Abstract] The author reports on the development of improved explosives and blasting technology at the Frunze Polytechnical Institute (FPI). These developments have been nominated for the Kirgiz SSR State Prize.

It is recalled that the task of developing more economical blasting methods for open-cut mining was assigned to personnel of an industry scientific research laboratory, "Systems for Comprehensive Mechanization of Blasting," which was set up at FPI 10 years ago. This group was headed by Candidate of Technical Sciences I.A. Tangayev. After studying a number of blasting variants, they developed a low-density explosive mixture with an addition of foam polystyrene. A method was developed for foaming the polystyrene at blasting sites. The new mixture was named "FP" in honor of the developer-institute. It has been accepted for permanent use by the USSR State Inspectorate for Technical and Mine Supervision.

N.I. Nifad'yev, head of the FPI laboratory, is quoted in regard to results of work on the development of new compositions which is now in progress here. He mentioned that nonexplosive components have been found for mixtures which are capable of completely replacing industrial explosives. As compared with the latter, these mixtures are one-third as expensive, have better characteristics and make it possible to quarry decorative stones and crystalline minerals without destroying them. Units for foaming polystyrene reportedly have been developed by laboratory associates under the direction of Candidate of Technical Sciences G.I. Degtyarev. The delivery, measuring-out and mixing of components of mixtures and the loading of blastholes have been completely mechanized.

FTD/SNAP  
CSO: 1865/120

## SUPERDEEP DRILLING PROJECT BEGINS IN UZBEKISTAN

Tashkent PRAVDA VOSTOKA in Russian 17 Oct 84 p 3

[Article by A. Lazarev]

[Abstract] The article reports on the start of drilling of the first superdeep geological-prospecting borehole in the Uzbek republic. Comments of G.V. Kasavchenko, chief engineer of the Kyzylkumy Geology Production Association, in regard to this project are recorded. The site of the superdeep borehole is located near the Muruntau geologists' settlement in the Kyzylkumy Desert. Plans call for sinking this borehole initially to a depth of 6,000 meters, and possibly to 7,000 meters if need be.

Kasavchenko mentions some of the organizations that are collaborating with the geology association. Expeditions of the Moscow Geological-Surveying Central Scientific Research Institute of Nonferrous and Precious metals and the Central Asian Scientific Research Institute of Geology and Mineral Raw Materials are to work at the Muruntau borehole. The project will be under the direction of the USSR State Planning Committee, the State Committee for Science and Technology, and the USSR Academy of Sciences. Modern turbojet equipment is in use and the latest drilling technology has been introduced at the Muruntau project. This technology was developed with experience of the Kola superdeep drilling project taken into account. Plans call for the Muruntau borehole to reach a depth of 2,000 meters by 1986.

FTD/SNAP  
CSO: 1865/120

TYUMEN' SUPERDEEP DRILLING PROJECT TARGETS 15 KM

Moscow IZVESTIYA in Russian 19 Nov 84 p 1

[Article by M. Yergina]

[Excerpt] The designing of the first superdeep-drilling rig for West Siberia has been completed at the Sverdlovsk Scientific Research Institute of Heavy Machine Building. Depths on the order of 15 kilometers in the interior of our country's largest oil and gas province will be probed with the aid of this rig. A new superdeep borehole here will become the country's third, after the Kola and Saatly ones. It will open new pages in geology and indicate the prospects of finding oil and gas at low levels of the Earth's crust.

The Tyumen' superdeep-drilling rig will be built far beyond the Arctic Circle, where conditions are considerably more difficult than they are in Azerbaydzhan or on the Kola Peninsula, for example. Work will begin at the Tyumen' site in the fall of next year. It will be necessary to build access roads, lay a foundation for the drilling rig and build a power plant, housing, warehouses and auxiliary buildings.

The new drilling rig will be the creation not only of the Urals Heavy Machine Building Plant but also dozens of other plants of the country, including ones in Leningrad, Tashkent and Khar'kov.

FTD/SNAP  
CSO: 1865/151

ACOUSTIC RECORDING OF NEUTRINOS STUDIED DEEP IN SALT MINE

Kiev RABOCHAYA GAZETA in Russian 14 Dec 84 p 2

SHEVCHENKO, P.

[Abstract] The brief article reports that associates of the chair of physics of the Voroshilovgrad Machine Building Institute are doing studies with a neutrino detector installed in a salt mine at a level 300 meters beneath the city of Karlo-Libknekhtovsk. The detector is a large tank filled with a liquid reagent.

G. T. Zatsepin, member of the USSR Academy of Sciences, is quoted regarding the studies: "The work of the group of young Voroshilovgrad physicists, who are headed by Candidate of Sciences P. I. Golubnichiy, is making a substantial contribution to our notions about the registration of flows of neutrinos using acoustical methods. This is important in connection with work which physicists around the world are doing on an international project for the deep-water registration of muons and neutrinos precisely on the basis of acoustics. The time is not far off when scientists of various countries will unite efforts to create a huge detector with a volume of perhaps 10 cubic kilometers in the ocean, and will listen to the neutrino and its 'stories' about remote cosmological processes, and then make this particle help us search for minerals in the Earth."

FTD/SNAP  
CSO: 1865/171

## EARTHQUAKE-MODELING EXPERIMENT USING UNIQUE PRESS

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 25 Nov 84 p 4

LAMANOV, G.

[Abstract] The article records a conversation with Gennadiy Aleksandrovich Sobolev, head of a department of the Institute of Earth Physics imeni Shmidt and a USSR State Prize Laureate, regarding a laboratory earthquake-modeling experiment for the purpose of simulating precursor phenomena. The aim is to study the behavior of these phenomena and to identify the most reliable ones. The experimenters are using a unique press which was developed under the direction of Academician L. Vereshchagin and Doctor of Technical Sciences A. Semerchan at the USSR Academy of Sciences' Institute of High-Pressure Physics. Stresses similar to those occurring at deep levels of the earth are produced in specimens of rock with the aid of this press. Rock samples from earthquake zones of the USSR are being used in the experiment, as well as blocks made of artificial materials in which breakdown centers have been created in advance. Elastic stresses which take decades or centuries to accumulate in the earth itself can be built up in 7-10 days by varying the loads on specimens in the press, it is claimed. 'Mini-earthquakes' produced by this method reportedly have been forecast with 90 percent accuracy by associates of Sobolev's department.

Comparisons of data from the experiments with results obtained in natural earthquake forecasts indicate that precursor phenomena behave similarly in both laboratory and field conditions, according to Sobolev. The modeling experiments also are said to have shown that there is a set of indicator-phenomena on whose basis a universal earthquake-forecasting method could be developed.

FTD/SNAP  
CSO: 1865/171

UDC 551.242.12(571.6)

## LOCALIZATION OF DESTRUCTION PROCESS

Ashkhabad IZVESTIYA AKADEMII NAUK TURKMENSKOY SSR, SERIYA FIZIKO-TEKNICHESKIKH, KHMICHESKIKH I GEOLOGICHESKIKH NAUK in Russian No 2, 1984  
(manuscript received 20 Apr 82) pp 30-35

MUKHAMEDOV, V. A., Physical Technical Institute, Turkmen Academy of Sciences

[Abstract] According to current concepts, the focus of a tectonic earthquake is the site of a loss of continuity of rock caused by stresses accumulated due to shear deformations over a period of time. The beginning of the process is massive fracture formation, which has been observed in model fracture experiments and is recorded by acoustical methods. There is particular interest in study of the intermediate stage of the process, localization of fracture, i.e., drawing a system of fractures scattered over a large area into a narrow zone where the major fracture will form. This work attempts to formulate a model of the formation of such an area of instability and determine the necessary conditions for occurrence of the process. The Pines theory of the growth of a single fracture by accumulation of vacancies under conditions of constant supersaturation is extended to a set of fractures with a constant concentration of vacancies. It is shown that a process of coalescence results which, if the boundaries of the fracture area are considered, results in localization of the destruction process. References: 13 Russian.

[4-6508]

UDC 551.242.12(571.6)

## VERTICAL MOVEMENTS AND STRUCTURE FORMATION WITHIN ISLAND SYSTEMS OF NORTH-EAST ASIA

Novosibirsk TIKHOKEANSKAYA GEOLOGIYA in Russian No 4, Jul-Aug 84  
(manuscript received 5 Feb 83) pp 15-28

SYCHEV, P. M., ZAKHAROV, V. K. and SEMAKIN, V. P., Sakhalin Complex Scientific Research Institute, Far Eastern Scientific Center, USSR Academy of Sciences, Novoaleksandrovsk

[Abstract] This article demonstrates that combination of geological and geo-physical data available for northeast Asia allows an explanation of most crustal deformations involving magmatic activity. The mechanism of magma movement is discussed and phenomena which may accompany this process are noted. Recent and contemporary vertical movements of Kamchatka, Sakhalin and Japan are diagrammed and discussed. It is characteristic that these islands have inherited many features of the earlier history of tectonic

development. Flow and more rapid movements both change direction over time in this area. A comparison of deformations with gravitational anomalies shows that upward movements are accompanied by entry of masses into the crust, which is anomalous in structure, with current-conducting layers present at depths of 10 to 15 km. Magmatic activity in the region is manifested as gradual, discontinuous upward movement of magma melts with the formation in the base of the crust and in the upper mantle of zones of partial melting. The end products of differentiation of the melts reach the upper portions of the cross section of the crust where the magma apparently crystallizes rapidly. Injection of melts at various levels is accompanied by hydrochemical interaction of the melts with the surrounding rock, causing deformation of overlying layers. The two conducting layers at depths of 10 and 15 km and near the base of the crust apparently predominate in determining the nature of vertical movements. Figures 9, references 67: 35 Russian, 32 Western.

[85-6508]

UDC 551.24(571.645)

#### BASIC STRUCTURAL FEATURES AND PROBABLE MECHANISM OF FORMATION OF THE KURIL ISLAND SYSTEM

Novosibirsk TIKHOKEANSKAYA GEOLOGIYA in Russian No 4, Jul-Aug 84  
(manuscript received 15 Nov 83) pp 29-40

SERGEYEV, K. F., Sakhalin Complex Scientific Research Institute, Far Eastern Scientific Center, USSR Academy of Sciences, Novoaleksandrovsk

[Abstract] The Kuril Island system, consisting of the upthrust island arc and accompanying Kuril-Kamchatka deep water trench, extends for almost 1200 km. The author's institute and other organizations have undertaken geological and geophysical observations, determining the geomorphological statistics of the region, its deep structure and geodynamic status. Based on the geological structure of the area, the geophysical specifics of the island system and the deep structure of the upper portion of the lithosphere in the area, a dynamic model of the formation of the Kuril Island system is developed which explains all of its most important geomorphological, geological and geophysical peculiarities and is not contradicted by the results of theoretical and experimental studies of possible elastic bending of the lithosphere under the influence of the horizontal compressive load. The suggested mechanism of formation of island systems is essentially an alternative to the most popular current assumption of subduction of oceanic lithospheric plates beneath continental plates in the area of deep water trenches. The new hypothesis frees the "new global tectonics" from a number of contradictions. The spreading of the oceanic lithosphere with time is a continuous process, while deformation of lithospheric plates such as those described in this

article is a periodic process. Deformations arise apparently when the compressive load exceeds the tensile strength of the lithosphere in areas of the greatest thickness gradient. The authors ask whether processes of periodically repeated folding and successive increases in the area of the continent are but a reaction of the earth's upper envelope to the process of continuous rejuvenation and spreading of the ocean lithosphere. Figures 6, references 26: 23 Russian, 3 Western.

[85-6508]

UDC 551.762.12+56:59:551.762.12(571.65)

NEW DATA ON MIDDLE JURASSIC BIOSTRATIGRAPHY IN THE AREA OF KONI AND P'YAGINA PENINSULAS

Novosibirsk TIKHOKEANSKAYA GEOLOGIYA in Russian No 4, Jul-Aug 84  
(manuscript received 19 Apr 83) pp 41-48

KOSHELKINA, Z. V., TEPLYKH, V. I., YUDIN, V. D. and VOROB'YEV, Yu. Yu., Central Geophysical Expedition, Sevvostgeologiya Production and Geological Association, Northeast Complex Scientific Research Institute, Far Eastern Scientific Center, USSR Academy of Sciences, Magadan

[Abstract] Recent studies of the Koni peninsula region have yielded new data requiring a reanalysis of the stratigraphy of the Jurassic deposits in the area. Recent materials and paleontological collections have allowed corrections to be made to the biostratigraphic system, revised in 1975 by the stratigraphic council. Based on these data, the Middle Jurassic can be subdivided into the Asatkan, Odyan, Ekvun, Labyrintov and Umarin suites. Each of these suites is described. Figures 1; references: 12 Russian.

[85-6508]

UDC 550.361+551.2

THERMAL CONDITIONS AND THINNING OF LITHOSPHERE IN LATE CENOZOIC IN SOUTHWESTERN USA

Novosibirsk TIKHOKEANSKAYA GEOLOGIYA in Russian No 4, Jul-Aug 84  
(manuscript received 31 Mar 83) pp 49-59

ZORIN, Yu. A., LEPINA, S. V. and LYSAK, S. V., Earth's Crust Institute, Siberian Department, USSR Academy of Sciences, Irkutsk

[Abstract] An attempt is made to construct a two-dimensional summary model of the Basin and Range province, Colorado plateau and Rio Grande rift by solution of the heat conductivity equation for the unsteady case using

simplified concepts of the mechanical displacement of the lithosphere by the asthenosphere and considering data on dating of geological events. For the first two regions the analysis is limited to the regional heat flow field, while for the Rio Grande rift an attempt is made to analyze a local heat source in the crust (large dike). The sequence of geological events in the Cenozoic is outlined and the model considers very rapid and slow introduction of the asthenosphere into the lithosphere. The model correlates the available information on heat flow with geological data on the heat structure and the chronology of geological events. In spite of a number of arbitrary aspects, the model does demonstrate rather convincingly that the surface of the asthenosphere appeared at its current depth beneath the Basin and Range province and beneath the Rio Grande rift no more than a few million years ago. The great dike was injected into the crust in the area of the Rio Grande rift equally recently. Beneath the Colorado plateau the surface of the asthenosphere appeared at its present depth at least 30 million years ago. The crust in the Basin and Range province and Rio Grande rift is continuing to heat. Figures 5, references 34: 10 Russian, 24 Western.

[85-6508]

UDC 550.831+550.838

#### PROSPECTS AND MEANS FOR DEVELOPMENT OF THEORY AND PRACTICE OF INTERPRETATION OF GRAVITATIONAL AND MAGNETIC ANOMALIES

Novosibirsk TIKHOKEANSKAYA GEOLOGIYA in Russian No 4, Jul-Aug 84  
(manuscript received 2 Nov 83) pp 60-70

STRAKHOV, V. N., Earth Physics Institute, USSR Academy of Sciences, Moscow

[Abstract] This article is a "fragmentary exposition" of the subject outlined in the title, the primary theses of which are as follows: development of gravimetric and magnetic prospecting depends at present on the development of systems and methodological, technical, mathematical, and geological-interpretation aspects. The major tasks in each of these fields are outlined. The significance and specific importance of these aspects differ for various methods. The systemic and methodological aspect is particularly important. The technical aspect involves the development of both measurement and computer equipment for studies in the area. The theory of interpretation of gravitational and magnetic anomalies is at present preparing to make a new turn in the spiral of its development, involving revision of a number of classical means for extraction of information from gravitational and magnetic observations at a new methodological and analytic level. Means for revision of some of the classical means for extracting information are analyzed in brief analytic form as they relate to the problem of field transformation. The approaches to revision of the four classical

segments of the theory of interpretation of gravitational and magnetic anomalies allow extraction of information from data generated in multiple-element surveys. References: 23 Russian.  
[85-6508]

UDC 553.441:550.312(571.6)

#### RELATIONSHIP OF GOLD CONTENT TO GRAVITY FIELDS IN FAR EAST

Novosibirsk TIKHOKEANSKAYA GEOLOGIYA in Russian No 4, Jul-Aug 84  
(manuscript received 2 Feb 83) pp 94-98

EYRISH, L. V., Far Eastern Mineral Raw Materials Institute, Khabarovsk

[Abstract] Gold content increases with depth in the earth. Gravimetric materials can be used to divide territories into those which are and are not potentially gold bearing. Areas with regional gravity maxima are potentially gold bearing. Data from the Sikhote-Alin area on the relationship of gold content and the regional gravimetric field confirm the idea of a relationship between gold ore formation and deep processes, the participation of mantle substance in ore formation and possible transformation of feric materials by granitoid magmas. Figures 3, references: 24 Russian.

[85-6508]

UDC 550.83

#### MATHEMATICAL MODELING OF WAVE FIELDS BY SUPERIMPOSITION OF BOUNDARY WAVES IN REFLECTED EARTHQUAKE WAVES METHOD

Novosibirsk TIKHOKEANSKAYA GEOLOGIYA in Russian No 4, Jul-Aug 84  
(manuscript received 20 Jan 84) pp 103-114

LUNEVA, M. N., Tectonics and Geology Institute, Far Eastern Scientific Center, USSR Academy of Sciences, Khabarovsk

[Abstract] Study of the Far East ore regions by the method of exchange waves excited by earthquakes has introduced a number of difficulties in the interpretation of field seismograms. The necessity of detailed study of the kinematic and dynamic characteristics of these types of waves, which carry information on structural specifics of seismogeological boundaries, has increased interest in the method of mathematical modeling of wave fields for this method. A method of mathematical modeling of wave fields from complex boundaries based on the concepts of the theory of boundary waves, the method of superimposition of boundary waves,

has been developed. This method is quite flexible, correct for a broad class of wave phenomena, physically clear and economical of computer time. The method has been used to develop an algorithm for computation of wave fields of transmitted longitudinal (PP) and exchange (PS) waves in a two-layered medium with a cylindrical boundary of arbitrary shape. Theoretical seismograms are presented for various structures (fault, anticline, syncline, undulating boundaries). Mathematical modeling of wave fields based on the method of superimposition of boundary waves is found to allow effective prediction of wave fields of transmitted longitudinal and exchange waves in the method of exchange waves excited by earthquakes for boundaries with plicative and disjunctive structure. The increase in effectiveness of mathematical modeling in interpreting the materials results from the creation of algorithms for computation of wave fields for more complex models than the calculation of wave fields for other types of waves. Figures 9; references: 3 Russian. [85-6508]

UDC 536.22.083

#### SOME SPECIFICS OF METHODS FOR MASS DETAILED STUDIES OF ROCK HEAT CONDUCTIVITY

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: GEOLOGIYA I RAZVEDKA  
in Russian, No 4, Apr 84 pp 76-84

POPOV, Yu. A., Moscow Geological Prospecting Institute imeni  
Sergo Ordzhonikidze

[Abstract] Heat conductivity determinations using a mobile point heat source allow massive thermophysical studies of rock under both laboratory and field conditions. The method allows detailed recording of heat conductivity distribution in specimens without requiring mechanical processing of a core and allows several hundred measurements to be performed in one day. The source used is not an ideal source such as that which forms the basis of the theoretical model. This article discusses the specifics of the method related to this difference, estimates the depth of heat conductivity studies performed by the method and presents recommendations for processing of information obtained using the method. The depth of the method refers to the thickness of the rock layer heated by the point source. It is found to be possible to exclude the systematic error resulting from the difference between the actual energy source and the idealized source from the results in each case of measurement. The depth of the method is determined by the rate of movement of the source and temperature conductivity of the rock. Thermograms can be used for determination of equivalent heat conductivity of individual specimens and intervals in a borehole. Figures 4, references: 4 Russian. [6-6508]

UDC 550.83:553.94(470.312)

OPTIMUM SCHEMES FOR ELECTRIC PROSPECTING IN ELECTRIC TRANSMISSION STUDIES  
OF COAL SEAM IN MOSCOW COAL BASIN

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: GEOLOGIYA I RAZVEDKA  
in Russian, No 4, Apr 84 pp 85-89

KISELEV, N. N. and TUMANOV, V. V., "Novomoskovskugol" Production Association,  
USSR Ministry of the Coal Industry

[Abstract] Electric profiling has been used in the Moscow coal basin in addition to seismic prospecting since the early 1970's. However, traditional symmetrical profiling is limited in its resolution. The authors have studied the system called electric transmission involving measurements with dc or low-frequency ac in which the transmitting and receiving electrodes are located in neighboring mine openings with a dipole installed opposite one of the feeder ground connections. The advantage of this installation results from the "shading" influence of a heterogeneous object which may be present between the source and receiving unit. Electric transmission profiling is performed by simultaneous movement of the feeding and receiving dipoles. Laboratory experimental work and theoretical computations have shown that electric profiling by this method with separation of feeder electrodes equal to the width of the mine shaft is the optimum arrangement for searching for karst dislocations. Practical operations in Moscow basin coal mines have proven the advantages and high effectiveness of the installation and methods. Figures 3, references: 3 Russian.  
[6-6508]

UDC 624.131.54

FRACTURE OF ROCKS AS MACROPOLAR MEDIA DURING CREEP

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: GEOLOGIYA I RAZVEDKA  
in Russian, No 4, Apr 84 pp 90-92

MOROZOV, V. N., Moscow Mining Institute

[Abstract] As applied to rock, a description of the process of deformation and fracture as a single process of reaction of the medium to external pressure has a number of practical applications including calculation of the stability of mine openings. This approach to the problem requires modeling of rock as a macroheterogeneous medium consisting of elastically anisotropic components, the grains of the rock-forming minerals. This article utilizes a model of the medium consisting of structural elements, spherical grains, the elastic anisotropy of which is described by the tensor of isothermal compliance constants. The grains are surrounded by a cementing substance, the

resistance of which is determined by its toughness upon reorientation of grains. The structural element of the macropolar medium is thus a spherical elastically anisotropic grain surrounded by a viscous cement. Expressions are derived allowing the process of development of texture in the polydisperse medium to be described. It is assumed that there is a critical grain rotation angle relative to its initial position corresponding to full destruction of the bonds between the grain and the cement, and this bond breakage is considered an elementary failure event. Quantitative comparison of calculated failure under creep conditions with experimentally recorded acoustical emission upon loading of specimens or in the process of stress relaxation is found to be quite difficult. Reasons for this difficulty are briefly described. Figures 2 references 3: 2 Russian, 1 Western.  
[6-6508]

UDC 622.24.051.7

#### USE OF BSO-4 BITS FOR DRILLING HARD ROCK

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: GEOLOGIYA I RAZVEDKA  
in Russian, No 4, Apr 84 pp 140-141

FADEYEV, V. F., Institute of Superhard Alloys, Ukrainian Academy of Sciences

[Abstract] BSO-4 drilling bits have a semirounded profile. The 59 mm diameter matrix is divided by straight washing slots into 10 sectors. The matrix is equipped with radial tvesal hard alloy inserts and type ASS 250/200 and ASS 200/160 synthetic diamonds. The undercutting layer has cylindrical tvesal inserts. Every other sector of the matrix is equipped with radial tvesal inserts on the core-forming surface. The radial and cylindrical inserts overlap in the direction of height. The tvesal inserts work together with the diamond-containing layer to form a combined matrix with high wear resistance. The bit wears uniformly over its height and retains its outside and inside diameters throughout its working life. Comparative results of testing of various types of diamond bits drilling quartz and basite porphyrites, andesites, tuffs and basalts of drilling categories X-XI are presented in a table. One BSO-4 bit drilled 26.8 m at 1.91 m/hr, another 18.3 m at 1.83 m/hr, a third 19.5 m at 1.95 m/hr. The bits cost 42.3 rubles each, making them quite cost effective.

[6-6508]

UDC 550.312:556.33

APPROXIMATION OF DIFFERENCE IN WATER TABLE POSITIONS BY HORIZONTAL STRATUM  
IN STUDIES OF THEIR INFLUENCE ON GRAVITY

Ashkhabad IZVESTIYA AKADEMII NAUK TURKMENSKOY SSR, SERIYA FIZIKO-  
TEKHNICHESKIKH, KHMICHESKIKH I GEOLOGICHESKIKH NAUK in Russian No 2, 1984  
(manuscript received 18 Nov 83) pp 65-71

KURBANOV, M. K. and KIRSTA, O. B., Seismology Institute, Turkmen Academy  
of Sciences

[Abstract] A study is made of the possibility of representing the differences in positions of ground water level as a horizontal stratum in studies of the influence of differences in ground water level on the force of gravity at a number of points in the Ashkhabad geodynamic test area. This area is located in the northern mountainous portion of central and eastern Kopet-Dag, its piedmont plain and the southern edge of the Kara Kum lowlands. In studies of the interrelationship between water table depth and gravity, changes in water level were compared to corresponding variations in the gravitational field. Physical processing of the materials was performed by computer using standard programs. It is found to be sufficient in the studies to consider water level changes at distances not over 1 km from the gravimetric reference point. In most cases water level changes are uniform within the limits of this distance. For such points there is a linear relationship between water level and gravity allowing the horizontal stratum approximation to be used. In some areas the difference in positions of ground water level differs significantly from a plane stratum due to various conditions of feeding and drainage of ground water, heterogeneity of soils or other factors. In these cases, the horizontal stratum approximation yields only approximate results. Figures 1; references: 6 Russian.  
[4-6508]

UDC 528.389:551.24

STUDY OF TECTONIC EARTHQUAKE PRECURSORS BY GEODETIC METHODS

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 8, Aug 84 pp 39-44

STGALOV, V. M.

[Abstract] Deformations of the earth's surface which can be revealed by geodetic methods are among the most reliable earthquake precursors. A brief list is presented of geodetic leveling methods which have revealed the precursors of several earthquakes. To confirm the accuracy of determination of precursors of earthquakes based on the results of repeated leveling in epicenter zones and observations at Alma-Ata, the magnitudes of 7 earthquakes

which occurred in northern Tien Shan during measurement of tectonic precursors were calculated and compared to values based on seismologic measurements. The agreement found is satisfactory. A scientifically well-founded program of studies of tectonic movements by geodetic methods in the northern Tien Shan has thus established the presence of tectonic precursors of earthquakes, determined the distances over which they are manifested and shown the possibility of using the results of geodetic measurements in combination with geophysical and seismologic data to estimate the possible time of appearance of earthquake precursors. Figures 5, tables 1; references: 12 Russian.

[88-6508]

UDC 550.42:553.94(477.6)

#### URANIUM DISTRIBUTION IN DONETS BASIN COAL

Kiev DOKLADY AKADEMII NAUK UKRAINSKOY SSR, SERIYA B: GEOLOGICHESKIYE, KHIMICHESKIYE I BIOLOGICHESKIYE NAUKI in Russian No 6, Jun 84  
(manuscript received 15 Aug 83) pp 24-26

SERGEYEV, I. P., RAZUVAYEVA, R. I. and SHUMLYANSKIY, V. A., Geochemistry and Physics of Minerals Institute, Ukrainian Academy of Sciences; Dnepropetrovsk Mining Institute

[Abstract] Specimens characterizing coal seams C<sub>1</sub>-C<sub>2</sub><sup>7</sup> were taken from coal mines of Petropavlovsk and the central Donets Basin Coal regions. The uranium content was determined by f-radiography by preparation of transparent polished sections in epoxy resin. Radiographs were obtained by bombardment of the sections with a flux of neutrons with a total density of  $3.5 \cdot 10^{15}$  n/cm<sup>2</sup>. The uranium content in individual specimens varied from 0.01 to 1.5 g/t, median value 0.10 g/t, mean value 0.22 g/t, variation coefficient 91%. The mean content of 0.22 g/t is significantly lower than the mean content determined by less sensitive luminescent analysis (1.6 g/t). Diagenetic and katagenetic minerals such as pyrite, calcite, quartz and siderite, forming inclusions or veins, contain no significant uranium accumulations. Uranium content decreases from clarain-durain coal to clarain and ultraclarain coal. Tables 1; references: 4 Russian.

[5-6508]

UDC 551.14:550.34(477.75-498)

## SEISMIC DENSITY MODEL OF CRUST ALONG KERCH-VRANCEA GEOTRAVERSE

Kiev DOKLADY AKADEMII NAUK UKRAINSKOY SSR, SERIYA B: GEOLOGICHESKIYE, KHIMICHESKIYE I BIOLOGICHESKIYE NAUKI in Russian No 6, Jun 84  
(manuscript received 28 Jul 83) pp 26-29

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[Abstract] For a number of years the authors' institute has studied the structure of the crust and upper mantle in the southern Ukraine. This article presents results from combined interpretation of seismometry and gravimetry along geotraverse V Kerch-Tarkhankut Peninsula-Kiliya-Vrancea. Seismic studies were performed by deep seismic soundings in the Crimean peninsula and by refracted waves within the Black Sea. The basic regularities of velocity distribution were determined. A density model of the sedimentary cover in the Kerch-Kiliya segment was composed from data on the density of rocks from the moisture saturated state based on borehole studies. The gravitational effect of the crust was calculated from previously published seismic data. A broad gravitational minimum in the precarpathian depression is explained by the effect of the sedimentary cover. The gravitational effect of the crust determined relative to a standard shield column along the profile has positive value. This indicates a decrease in density of the mantle. Figure 1, references 12: 11 Russian, 1 Western.  
[5-6508]

UDC 552.322

## TECTONIC POSITION AND FORMATION OF YOUNG ALKALINE PROVINCES OF CONTINENTS AND OCEANS

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA GEOLOGICHESKAYA in Russian No 7, Jul 84 (manuscript received 10 May 83) pp 84-92

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[Abstract] Alkaline magmatism of the continents and oceans is compared on the basis of tectonics and formation history. Alkaline provinces are associated with the following major types of tectonic structures: intracontinental rift zones, particularly in Africa, but also in Europe and Asia; pericontinental rift zones around Africa, Australia and Antarctica; alpine geosynclinal belts of Europe, Africa, Asia, North and South America, as well as the islands of the Pacific; oceanic ridges in the western Pacific, Indian and Atlantic Oceans; and mid-oceanic rift belts. The formation of alkaline provinces of late Cretaceous and Cenozoic age coincides in position with the

world system of young riftogenous and folded geosynclinal structures. Series of alkaline formations of the sodium type show a clear tendency to be related to the rift system of the earth, while potassium type formations tend to be associated with geosynclinal structures. The intracontinental rifts have the most complete and best-contrasted series of alkaline and related formations. The sequence of alkaline formations of oceanic rifts is similar to the early members of the sequence of continental formations, with characteristic sodium geochemical specialization. Figures 1, tables 1; references 33: 11 Russian, 22 Western.

[27-6508]

UDC 552.3:551.76(517.3+571.6)

#### MESOZOIC MAGMATISM OF MONGOLIAN-OKHOTSK BELT AND ITS POSSIBLE GEODYNAMIC INTERPRETATION

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA GEOLOGICHESKAYA in Russian No 7, Jul 84 (manuscript received 18 Feb 83) pp 93-107

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[Abstract] The purpose of this article was to present an interpretation of the geodynamic position of Mesozoic magmatism of the Mongolian-Okhotsk belt by comparing it with contemporary magmatism of certain model regions, the geodynamic conditions of which have been well defined. It is found that the magmatism of the Mongolian-Okhotsk belt does not match with the geodynamic situation of oceanic or continental rifts, island arcs, or active continental shields, although features of all of these types of areas are observed. The greatest similarity is observed with contemporary or late Cenozoic magmatism of western North America, the so-called California model. Charts compare the paleotectonic systems of the Early and Late Mesozoic in the Mongolian-Okhotsk belt with the tectonic situation of western North America from the Columbia Plateau to Baja California, extending from the Colorado Plateau in the east into the Pacific in the west. Great similarities are found: in the central portion of the two areas in both cases, there is a marine bay with tholeiite magmatism; in the peripheral portions, limestone-alkaline, alkaline and bimodal magmatic series were formed under continental conditions. Zonal tectonic-magmatic areas involving these magmatic series are formed under geodynamic conditions such that the continental lithospheric plate covers a mid-oceanic ridge system. The magmatism of the Mongolian-Okhotsk belt, accompanied by concentrated ore formation, is apparently a result of California-type geodynamic conditions, under which the continental Siberian plate moved over the Paleothetys mid-oceanic ridge. Figures 4, references 56: 36 Russian, 20 Western.

[27-6508]

## NONLINEAR SEISMOLOGY

Moscow ZEMLYA I VSELENNAYA in Russian No 5, Sep-Oct 84 pp 56-62

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[Abstract] A brief analysis is presented of the nature of nonlinear effects in seismology. Nonlinear properties of a medium can be considered an independent characteristic having anomalies under certain conditions. For example, increased nonlinear properties are manifested by the jointed zones around geological fractures and gas-saturated porous collector zones. New methods of seismic processing in the future will study oil and gas deposits in fracture zones. These methods are referred to as nonlinear transillumination methods. They make use of the interaction of seismic waves. If two vibrators operating at different frequencies are placed on the surface, the two incident fields interact strongly in the area between them with nonlinear properties and this area begins to act as a three-dimensional antenna, radiating waves at the combination frequencies. These waves can be recorded at the surface points between the two vibrators and their amplitude, time and direction of arrival can be used to determine the location of the nonlinear area. Two vibrators located close together radiating high frequencies generate a wave at the difference frequency acting as a signal seemingly transmitted from a much larger vibrator at a lower frequency. Another nontraditional approach in seismology is to utilize waves from a distant natural source to interact with a high-frequency pumping vibrator and receiving system. Nonlinear seismology is very new and great results are expected from it in the future.

[98-6508]

UDC 550.348.432

## STATISTICAL STUDY OF ANTHROPOGENIC SEISMIC NOISE WITH IVK-7 COMPUTER SYSTEM

Ashkhabad IZVESTIYA AKADEMII NAUK TURKMENSKOY SSR, SERIYA FIZIKO-TEKHNICHESKIKH, KHIMICHESKIKH I GEOLOGICHESKIKH NAUK in Russian No 3, 1984  
(manuscript received 19 Apr 83) pp 39-46

KARRYEV, B. S., KANEL', Ye. G., POPOVA, I. A., STROGANOV, Ye. G. and  
TSYPLAKOV, V. V., Seismology Institute, Turkmen Academy of Sciences

[Abstract] An installation has been set up at the "Ashkhabad" Central Seismic Station to record anthropogenic seismic noise, using a type IVK-7 computer system to accumulate and analyze the data. Noise at 15 and 30 Hz is processed; digital information obtained in real time is sent to the memory of the SN-3 computer included in the system. A strip chart recorder

makes a continuous recording of the noise level at these two frequencies. The statistical characteristics, including distribution density, mean square values of random processes, autocorrelation function and spectral density were analyzed. The possibility is discussed of using the anthropogenic seismic noise from a large city to evaluate the stress state of nearby seismic focal zones. The most informative parameter is the frequency structure of high-frequency seismic noise. Long-term, continuous observations of the distribution of energy in the seismic noise spectrum may be informative for prediction purposes. Figures 3, references 12: 9 Russian, 3 Western.

[87-6508]

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